# CR

# Lithium Manganese Dioxide Battery ($Li/MnO_2$)

Primary Battery


## LITHIUM MANGANESE DIOXIDE BATTERY

## Safety Instructions

This battery contains lithium, organic solvents, and other combustible materials. For this reason, improper handling of the battery could lead to distortion, leakage*, overheating, explosion, or fire, causing bodily injury or equipment trouble. Please observe the following instructions to prevent accidents.
(* Leakage is defined as the unintentional escape of a liquid from a battery.)

## ⚠ Warnings — Handling

■ **Keep battery out of reach of children.**
Swallowing can lead to chemical burns, perforation of soft tissue, and death. Severe burns can occur within 2 hours of ingestion. If swallowed, seek medical attention immediately.

■ **Never charge.**
The battery is not designed to be charged by any other electrical source. Charging could generate gas and internal short-circuiting, leading to distortion, leakage, overheating, explosion, or fire.

■ **Never heat.**
Heating the battery to more than 100 deg. C* could increase the internal pressure, causing distortion, leakage, overheating, explosion, or fire. (* Consult Maxell regarding heat resistant coin type lithium manganese dioxide batteries.)

■ **Never expose to open flames.**
Exposing to flames could cause the lithium metal to melt, causing the battery to catch on fire and explode.

■ **Never disassemble the battery.**
Do not disassemble the battery, because the separator or gasket could be damaged, leading to distortion, leakage, overheating, explosion, or fire.

■ **Never reverse the positive and negative terminals when mounting.**
Improper mounting of the battery could lead to short-circuiting, charging or forced-discharging. This could cause distortion, leakage, overheating, explosion, or fire.

■ **Never short-circuit the battery.**
Do not allow the positive and negative terminals to short-circuit. Never carry or store the battery with metal objects such as a necklace or a hairpin. Do not take multiple batteries out of the package and pile or mix them when storing. Otherwise, this could lead to distortion, leakage, overheating, explosion, or fire.

■ **Never weld the terminals or weld a wire to the body of the battery directly.**
The heat of welding or soldering could cause the lithium to melt, or cause damage to the insulating material in the battery. This could cause distortion, leakage, overheating, explosion, or fire. When soldering the battery directly to equipment, solder only the tabs or leads. Even then, the temperature of the soldering iron must be below 350 deg. C and the soldering time less than 5 seconds. Do not use a soldering bath, because the circuit board with battery attached could stop moving or the battery could drop into the bath. Moreover do not use excessive solder, because the solder could flow to unwanted portions of the board, leading to a short-circuit or charging of the battery.

■ **Never use different batteries together.**
Using different batteries together, i.e. different type or used and new or different manufacturer could cause distortion, leakage, overheating, explosion, or fire because of the differences in battery property. If using two or more batteries connected in series or in parallel even same batteries, please consult with Maxell before using.

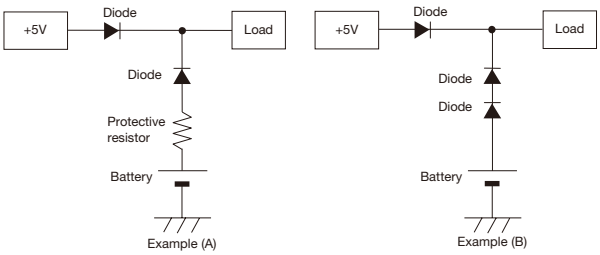
■ **Never allow liquid leaking from the battery to get in your eyes or mouth.**
Because this liquid could cause serious damage, if it does come in contact with your eyes, flush them immediately with plenty of water and consult a physician. Likewise, if the liquid gets in your mouth, rinse immediately with plenty of water and consult a physician.

■ **Keep leaking batteries away from fire.**
If leakage is suspected or you detect a strong odor, keep the battery away from fire, because the leaked liquid could catch on fire.

■ **Never touch the battery electrodes.**
Do not allow the battery electrodes to come in contact with your skin or fingers. Otherwise, the moisture from your skin could cause a discharge of the battery, which could produce certain chemical substances causing you to receive a chemical burns.

## ⚠ Warnings — Circuit Design for Back-up Use

This is a primary battery and cannot be charged. If used in memory or RTC back-up applications, be sure to use diodes to prevent charging from the main power source or other batteries, and a protective resistor to regulate the current as shown in the figure below. Note that the points described below should be taken into careful consideration when selecting diodes and protective resistors.




**■ Supplied voltage to load**

Because a diode and a resistor generate the voltage drop on operating, please take into consideration these voltage drops for supplied voltage to load.

**■ Using diodes to prevent charging**

Please choose diodes with leak current as small as possible. Please keep the charged capacity due to leak current to within 1% of nominal capacity.

**■ Using and setting protective resistors**

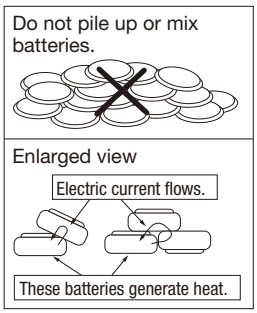
A protective resistor is used to prevent the battery from being charged by large surges of current during diode failure. Please set the resistor so that the maximum current shown in the right table is not exceeded. For example, say a CR2032 battery is used in sample circuit (A) in combination with a main power source 5 volt. Since the permitted charge current is 10mA and this battery's voltage is 3V, let the resistor be R≧(5V-3V)/10mA=0.2k ohm, meaning that at least 0.2k ohm is required.

| Type | Maximum Current |
|---|---|
| CR2450HR | 15mA |
| CR2450HR-Ex | 15mA |
| CR2050HR | 10mA |
| CR2032HR | 10mA |
| CR2032H | 10mA |
| CR2032 | 10mA |
| CR2025 | 10mA |
| CR2016 | 10mA |
| CR1632 | 4.0mA |
| CR1620 | 4.0mA |
| CR1616 | 2.5mA |
| CR1220 | 3.0mA |
| CR1216 | 2.5mA |
| CR17450 AH | 20mA |
| CR17450 A | 20mA |
| CR17335 A | 20mA |

Note: If the diodes broke down, it is necessary for safety to replace them as soon as possible even though using a protective resistor. Considering the trouble of diodes and resistors, other safety measures should be incorporated in the circuit design.

## ⚠ Warnings — Disposal

The battery may be regulated by national or local regulation. Please follow the instructions of proper regulation. As electric capacity is left in a discarded battery and it comes into contact with other metals, it could lead to distortion, leakage, overheating, or explosion, so make sure to cover the (+) and (-) terminals with friction tape or some other insulator before disposal.




(Example of battery insulation)

## ⚠ Caution — Handling/Storage

**■ Never expose the battery to ultrasonic sound.**

Exposing the battery to ultrasonic sound may cause short-circuiting because the inside material is broken into pieces, leading to distortion, leakage, overheating, explosion, or fire.

**■ Never subject the battery to severe shock.**

Dropping, throwing or stomping on the battery may cause distortion, leakage, overheating, explosion, or fire.

**■ Never short-circuit the battery while installing into equipment.**

Please be careful when installing the battery not to short-circuit it with metal portions of the equipment.

**■ Use the correct battery suitable for the equipment.**

The battery may not be suitable for the specific equipment due to the using conditions or type of equipment. Please select the suitable battery according to the handling instructions of the equipment.

**■ Never use or leave the battery in a hot place such as under the direct rays of the sun or in a car in hot weather.**

If you do, this may cause distortion, leakage, overheating, explosion, or fire.

**■ Never allow the battery to come in contact with water.**

If it does, this may cause the battery to rust or lead to distortion, leakage, overheating, explosion, or fire.

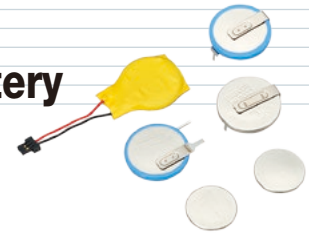
**■ Never store the battery in a hot and humid environment.**

Otherwise it may cause battery performance deterioration, deformation, leakage, overheating, or explosion.

**■ Keep contact force more than 2N.**

The battery voltage may be lower than intended value because of poor contact condition, please keep contact force more than 2N for suitable contact resistance.

# Coin Type Lithium Manganese Dioxide Battery





## Overview

The coin type lithium manganese dioxide battery (CR battery) is a small, lightweight battery with an operating voltage of 3V and the ability to operate over a wide temperature range. It has a wide range of applications, both for powering devices such as wristwatches and electronic calculators and can be used in all types of electronic devices mainly as memory and RTC backup.

## Features

**■ Optimum for Memory and RTC Backup (Fig. 1)**
Displays long-term stable operating voltage at low load discharge.

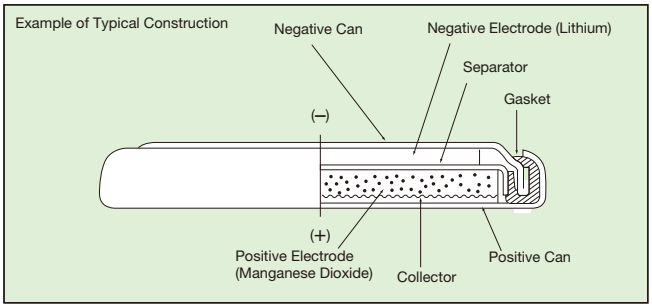
**■ High 3 volt energy density**
High energy density. At 3 volts (nominal voltage), it has about twice the voltage of alkaline button batteries and silver oxide batteries.

**■ Stable discharge characteristics through low internal resistance and high operating voltage**
Employs highly conductive electrolyte, lowering internal resistance and providing stable operating voltage. This allows stable power to be obtained, with little change in operating voltage at room temperature as well as high and low temperatures.

**■ Superior leakage resistance and excellent storage characteristics (Fig. 2)**
Employs a leak-resistant organic electrolyte, giving it better leakage resistance than battery types using alkaline electrolytes. Furthermore, the high degree of seal of the seal structure and application of sealant keep self-discharge to about 1% per year.

**■ Superior high rate discharge characteristics**

## Construction



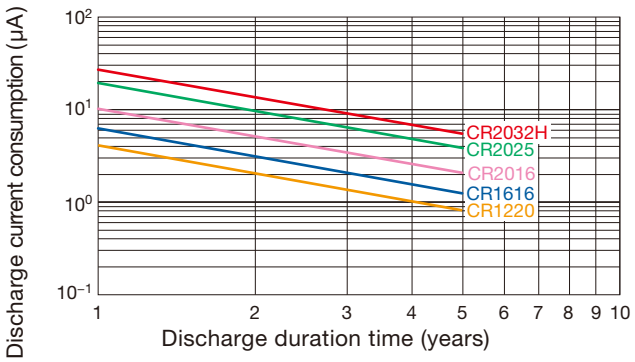

## Principle and Reactions

The coin type lithium manganese dioxide battery uses manganese dioxide ($MnO_2$) as its positive active material, lithium (Li) as its negative active material, and an organic electrolyte solution.

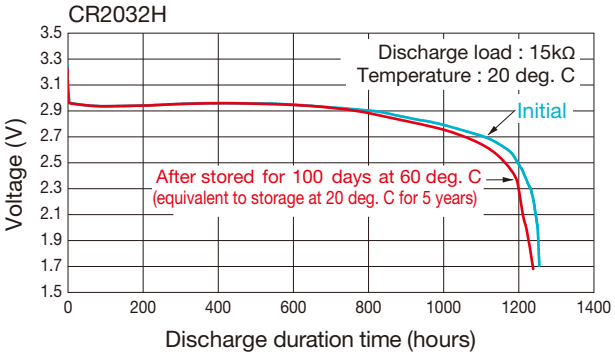
**■ Battery reactions**

Positive reaction: $MnO_2 + Li^+ + e^- \rightarrow MnOOLi$
Negative reaction: $Li \rightarrow Li^+ + e^-$
Total reaction: $MnO_2 + Li \rightarrow MnOOLi$

## Fig. 1 Relationship between Discharge Current Consumption and Duration Time




## Fig. 2 Discharge Characteristics after Storage




## UL Recognized Components

The coin type lithium manganese dioxide battery is a UL (Underwriters Laboratories Inc.) recognized component and user replaceable.

Recognized models:
CR2032H, CR2032, CR2025, CR2016, CR1632, CR1620, CR1616, CR1220, CR1216

Certification Number: MH12568

## Applications

- Communication Tags
- OA Machines (Fax, Copiers, Printers)
- Digital Still Cameras
- Medical Instruments, Cash Registers
- Electronic Meters (Water, Gas, Electricity)
- FA Instruments (Measuring Instruments, Onboard Microcomputers, Sensors)
- Notebook PCs
- Electronic Dictionaries
- Camcorders
- Keyless Entry Systems
- Remote Controllers
- Desktop PCs
- Calculators
- Watches
- Portable Game Devices

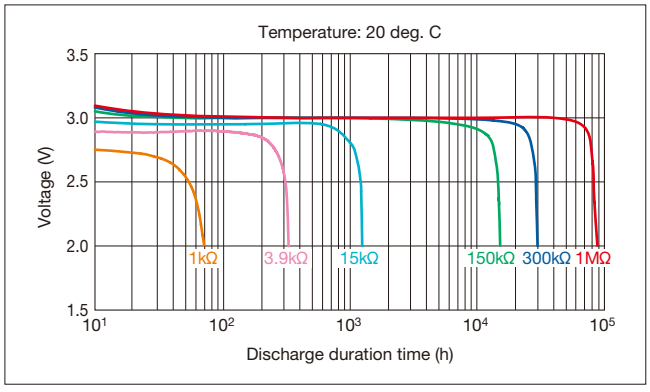
## Products

| Model | | CR2032H | CR2032 | CR2025 | CR2016 | CR1632 | CR1620 | CR1616 | CR1220 | CR1216 |
|---|---|---|---|---|---|---|---|---|---|---|
| Nominal Voltage (V) | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Nominal Capacity (mAh)*1 | | 240 | 220 | 170 | 90 | 140 | 80 | 55 | 36 | 25 |
| Nominal Discharge Current (mA) | | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Operating Temperature Range (deg. C)*2 | | −20 to +85 | | | | | | | | |
| Dimensions*3 | Diameter (mm) | 20.0 | 20.0 | 20.0 | 20.0 | 16.0 | 16.0 | 16.0 | 12.5 | 12.5 |
| | Height (mm) | 3.2 | 3.2 | 2.5 | 1.6 | 3.2 | 2.0 | 1.6 | 2.0 | 1.6 |
| Weight (g)*3 | | 3.0 | 3.0 | 2.5 | 1.7 | 1.9 | 1.3 | 1.1 | 0.8 | 0.6 |

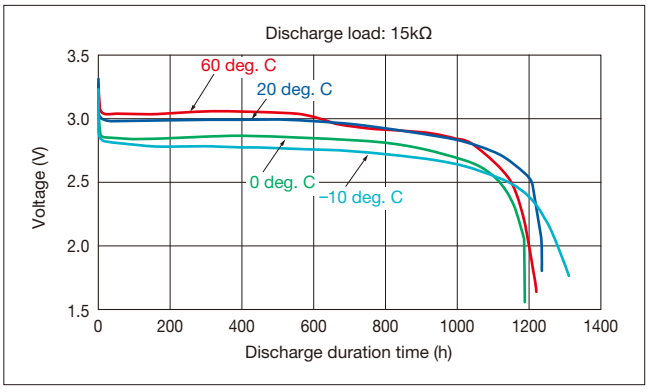
*1 Nominal capacity indicates duration until the voltage drops down to 2.0V when discharged at a nominal discharge current at 20 deg. C.
*2 When using these batteries at temperatures outside the range of 0 to +40 deg. C, please consult Maxell in advance for conditions of use.
*3 Dimensions and weight are for the battery itself, but may vary depending on terminal specifications and other factors.
• Data and dimensions are just reference values. For further details, please contact your nearest Maxell dealer or distributor.

## Characteristics (CR2032H)

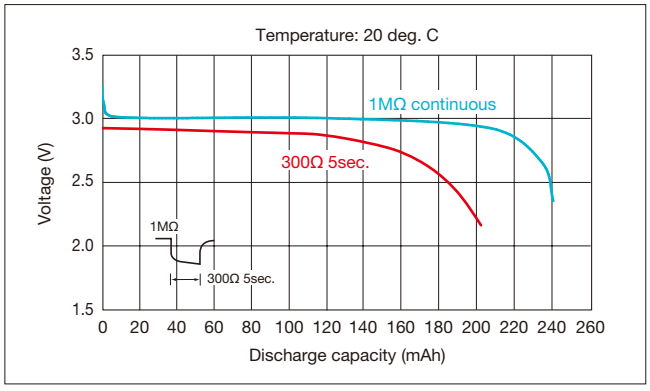
### Discharge Characteristics



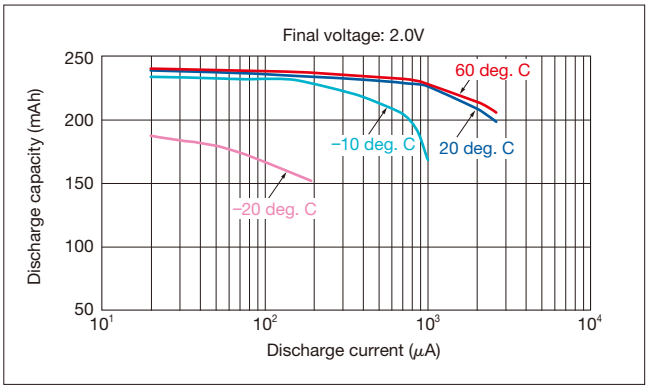

### Temperature Characteristics




### Pulse Discharge Characteristics

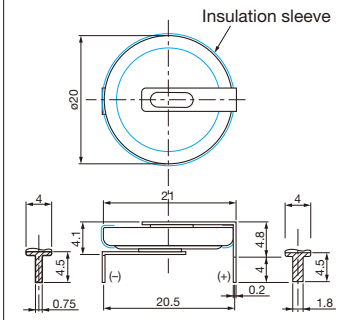



### Relationship between Discharge Current and Discharge Capacity

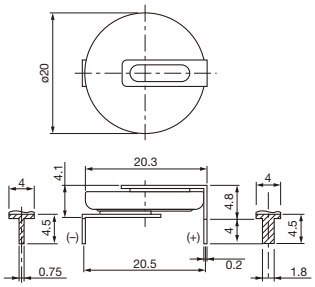


## External Dimensions with Terminals and Wire Connectors (unit : mm)

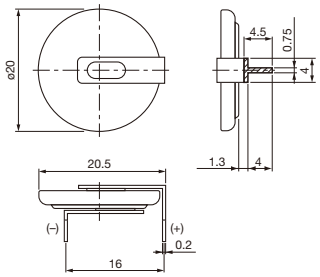
### CR2032 T6



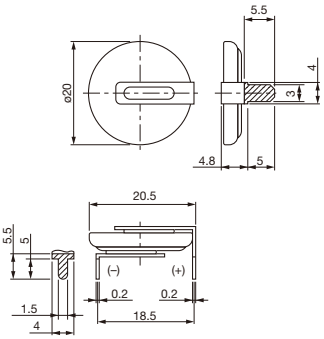

### CR2032 T6LES



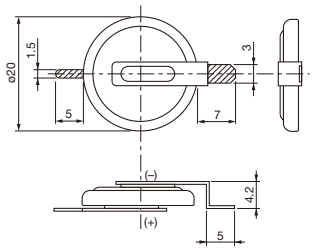

### CR2032 T19



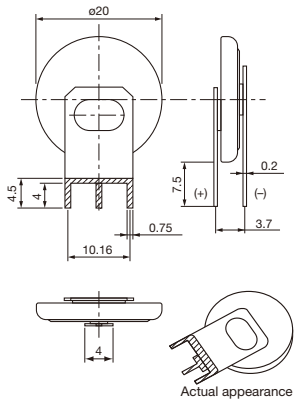

### CR2032 T23



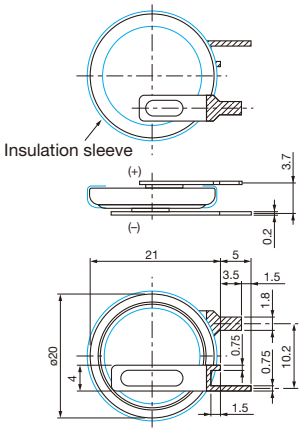

### CR2032 T33



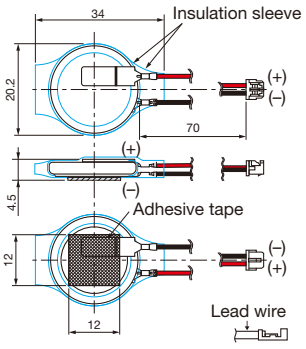

### CR2032 T26




### CR2032 T34

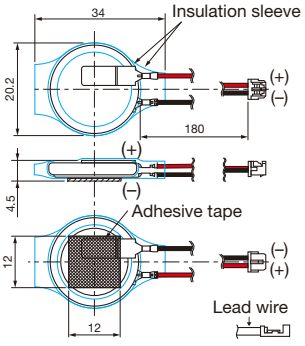



### CR2032 WK11



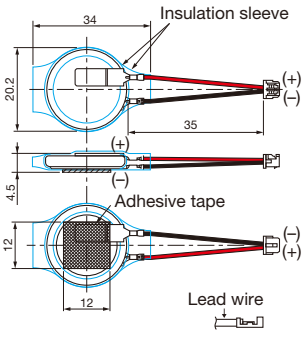

Housing: DF13-2S-1.25C (Hirose)
Contact: DF13-2630SCF (Hirose)
Wire: AWG28 UL1571

### CR2032 WK12



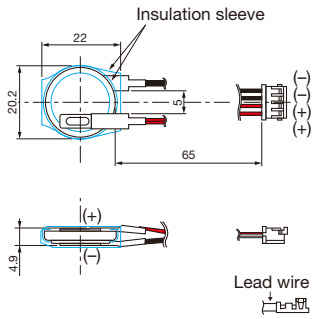

Housing: DF13-2S-1.25C (Hirose)
Contact: DF13-2630SCF (Hirose)
Wire: AWG28 UL1571

### CR2032 WK13



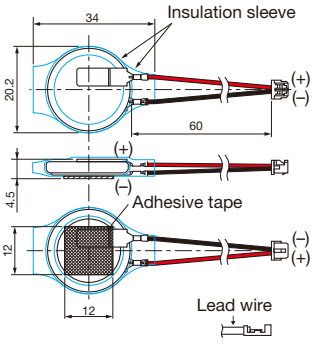

Housing: DF13-2S-1.25C (Hirose)
Contact: DF13-2630SCF (Hirose)
Wire: AWG28 UL1571

### CR2032 WK14




Housing: DF3-4S-2C (Hirose)
Contact: DF3-2428SCF (Hirose)
Wire: AWG26 UL1007

### CR2032 WK15




Housing: DF13-2S-1.25C (Hirose)
Contact: DF13-2630SCF (Hirose)
Wire: AWG28 UL1571

The above are examples. Processing to meet customer requests is possible.

: Horizontal & Through hole Type
: Horizontal & Surface mounting Type
: Vertical & Through hole Type
: Wire connector Type

: Tin plating

Visit our website for more information
http://biz.maxell.com/en/
Go to: Products > Primary Batteries > CR (Coin Type Lithium Manganese Dioxide Battery)

maxell
Within, the Future

## Visit our website at: biz.maxell.com

Maxell is accredited with international quality management standard ISO 9001 and international environmental management standard ISO 14001 certifications.

Catalog contents accurate as of January 2018.
Data and dimensions are just reference values.
Contents on this catalog are subject to change without notice.
Committed to the highest quality assurance management standards as well as responsibility to the environment.

**Maxell, Ltd. Energy Division**

VEGETABLE OIL INK

BATTERIES CATALOG(E) MXL-E1801 Printed in Japan